

Vib Meter 9084

User Guide: Version 1.0

Vibration Monitoring & Analysis



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CONTENTS

CONTENTS	2
DISCLAIMER	2
1 OVERVIEW	3
1.1 Turning the unit ON and OFF.....	3
1.2 Batteries.....	3
1.3 Service.....	3
2 OPERATION	4
2.1 Fitting the sensor.....	4
2.2 Taking a reading.....	4
2.2.1 Vibration readings.....	5
2.2.2 Vibration Analysis	6
2.2.3 Frequency spectrum	7
2.2.4 Live Update Mode.....	8
2.3 Configuration menus	8
2.3.1 Setup Wizard.....	8
2.3.2 Manual Setup	9
2.3.2.1 BDU alarm settings.....	9
2.3.2.2 Run Speed.....	9
2.3.2.3 Sensor mV/g	10
2.3.4 Device Settings	10
3 ASSET MANAGEMENT	11
4 VIB-TREND - TRENDING SOFTWARE	12
5 SPECIFICATIONS	13
6 BASIC OPERATION	14

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1 OVERVIEW


The **Vib Meter 9084** is a simple to use vibration monitoring and analysis tool that allows easy display of vibration signals. The meter automatically performs vibration analysis functions based on machine running speed to help diagnose faults such as unbalance, misalignment and looseness, as well as indicating the degree of bearing wear.

The Vib Meter 9084 unit is designed to enable a user to collect vibration measurements from assets (e.g. pumps, motors, fans and bearings). The unit displays vibration frequency plots and allows vibration severity and bearing condition to be monitored, analysed and trended with the included VibTrend PC analysis software.

1.1 Turning the unit ON and OFF

Turning the meter ON is achieved simply by pressing the center  or  button. The unit has an auto dimming feature that dims the display after 10 seconds to conserve battery life. Pressing any button will bring the unit back to full brightness. In addition, the 9084 will automatically turn OFF if not used for 1 minute (this time period can be increased up to 60 minutes using the Setup Wizard).

1.2 Batteries

The Vib Meter 9084 is powered by a wireless rechargeable Lithium-Ion battery. To charge the battery, remove the 9084 from the protective boot by prying the boot off from the bottom. Set the 9084 on the charging pad so the  symbol comes in contact with the pad. The display of the 9084 will turn on to indicate it is charging.



After removing the 9085 from the boot, place this area onto the charging pad.

1.3 Service

The Vib Meter 9084 contains no user serviceable parts. In the unlikely case of malfunction please return the complete unit to your supplier for repair.


2 Operation

2.1 Fitting the sensor

The Vib Meter 9084 is supplied with a cable connected accelerometer (sensor) that connects to the 5 pin M12 connector on the meter. The nominal sensitivity of the sensor is 30mV/g and this is the meter's default setting for sensor sensitivity.

The Vib Meter 9084 uses the A9100 standard low power accelerometer. The sensor sensitivity setting of the 9084 can be adjusted to accommodate different accelerometer sensitivities (see section 2.3.3.3 in Manual Setup).

2.2 Taking a reading

To take a reading, press the circle button  to turn the unit ON. Place the sensor on a **rigid** part of the machine as close as possible to the desired measurement point (e.g. bearing block) using the magnet mount.

Pressing the circle button again takes the reading.

N.B. for best results the sensor should be placed gently onto the measurement point by “rolling” the magnet onto the machine.

This is in order to avoid any sudden shocks that would be seen as large acceleration peaks by the sensor and could take some time (several seconds) to die away.



Taking a reading causes the overall vibration numbers to be displayed as shown in the example screen left.

This screen gives an overall view of the machine's vibration condition as explained in the following section.

2.2.1 Vibration readings

Once a vibration reading has been taken, the display will show three values, as shown in the example screen opposite. The values are colour coded to show their alarm status as explained in the following sections.



The four values shown in the readings screen are:

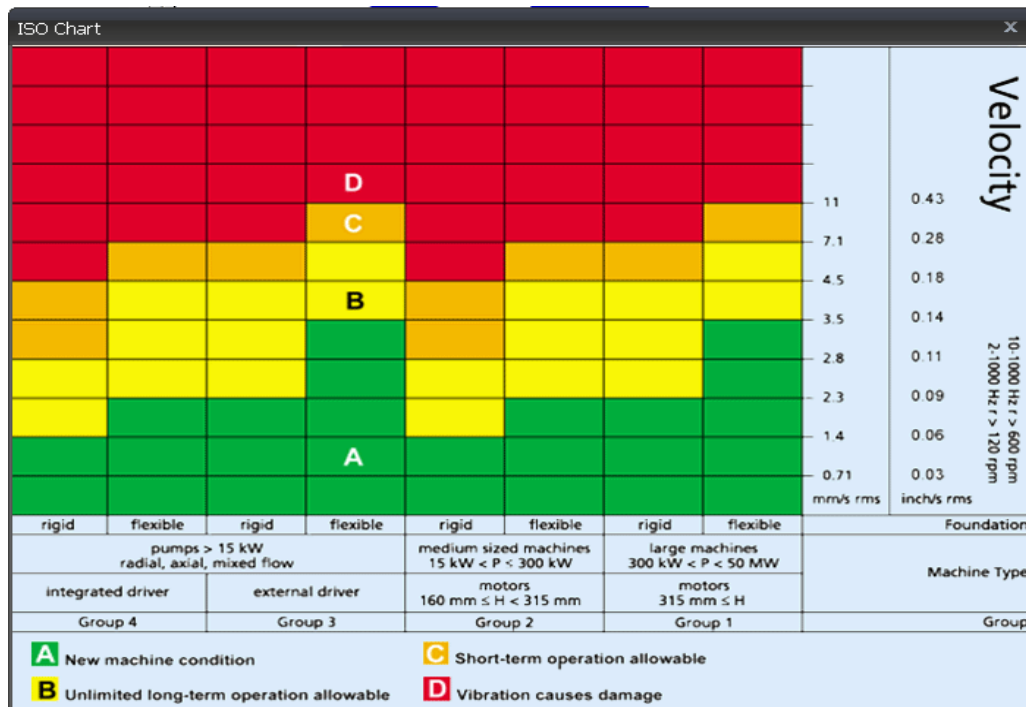
- ISO value (velocity in mm/second or inch/s)
- Bearing Noise in BDU (Bearing Damage Units)
- Total g (acceleration)

These readings are explained in more detail below with some examples of what they actually mean:

ISO value (mm/s)

The ISO value (in mm/s or inch/s) is the large number displayed at the top of the screen, which is the RMS (average) of the vibration velocity in the frequency band 10Hz (600 RPM) to 1kHz (60,000 RPM) or 2Hz (120 RPM) to 1kHz (60,000 RPM), as specified by the ISO standard¹. The correct frequency band is automatically selected by the meter based on running speed.

The ISO value background is colour coded according to the ISO 10816-1 vibration velocity level chart (see below). The colour coded background indicates the condition of the machine according to the size and type of machine selected with the **Setup Wizard** (see section 2.3.1).



¹ ISO 10816-1:1995. Mechanical vibration -- Evaluation of machine vibration by measurements on non-rotating parts

Bearing Noise (BDU)

Below the displayed ISO value and to the left is the value of bearing noise (high frequency vibration) in **Bearing Damage Units** (BDU), where 100 BDU corresponds to 1g RMS (average) vibration measured above 1kHz. This is a measure of the wear state of the bearings in the equipment being monitored. The higher the number, the more worn the bearing.

It is commonly held that 1g of high frequency vibration (100 BDU) corresponds to a relatively high level of bearing noise and so can be considered indicative of a damaged bearing. In other words, it may be helpful to think of the Bearing Noise figure as being very roughly equivalent to “**percentage**” of bearing wear. By default, the bearing noise is displayed on a **Red** background if it is above 100 BDU, an **Amber** background between 50 and 100 BDU and a **Green** background below 50 BDU. However, the BDU alarm levels can be changed using the **Manual Setup** menu (see section 2.3.2.1).

Total acceleration (g)

This is the RMS (average) value of the total vibration acceleration measured by the meter over its entire frequency range (2Hz to 10kHz). This reading is shown in units of **g** (Earth’s gravitational constant, where $1g = 9.81 \text{ m/s}^2$).

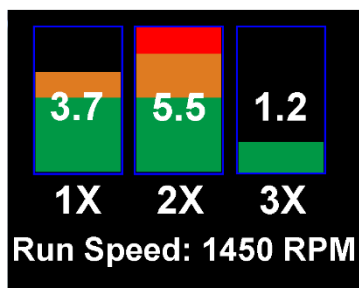
Displacement

Pressing either the left (<) or right (>) arrow button when the reading screen is displayed will cause the meter to display RMS displacement (in mm or thou) on a blue background. Pressing either left or right arrow button again will revert to display of the ISO value (mm/s or inch/s).

2.2.2 Vibration Analysis

Pressing the down arrow button brings up a display similar to that shown below, which shows the readings of vibration velocity (mm/s or inch/s), or displacement (mm or thou) if selected, broken down into each of 3 bands.

The display shows the vibration level in frequency ranges that are all based on multiples (1X, 2X and 3X) of the specified **Run Speed** of the machine as displayed beneath the 3 bar graphs.



N.B. in order to perform a vibration analysis it is important that the running speed of the machine is entered correctly. This can be done with the “Setup Wizard” as described in Section 2.3.1 of this user guide, or by using the strobe attachment (see Section 5.1)

The frequency ranges of the VA bands are based on the following multiples of running speed²:

² Multiples of running speed are sometimes referred to as “orders”

1X = Unbalance:

The level of vibration in the frequency band based on the running speed is usually indicative of how well balanced the machine is. A **large** vibration at the running speed usually indicates that the machine is out of balance. However even a very well balanced machine will typically show some vibration at the running speed but this figure should ideally be quite low (e.g. typically less than about 2 mm/sec for a medium sized machine).

2X = Misalignment:

A high level of vibration in the frequency band centred at twice the running speed is a possible indication of misalignment. This is based on the fact that shaft misalignment can result in a double peak in the waveform due to there being two different centres of gravity (one from each shaft). In other words the accelerometer picks up a peak as each centre of gravity passes by and hence there will be two positive and two negative peaks each revolution of the shaft. This will typically give rise to a vibration signal at **double** the running speed of the machine.

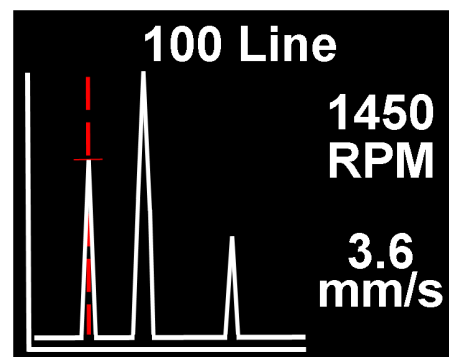
3X = Looseness:

High vibration in the frequency band centred at 3 times running speed is a possible indication that something may be loose (e.g. loose mounting bolts, weak foundations etc.) as it is not usual to see third order vibration in a machine unless there is some structural looseness that is being “excited” by the vibration of the machine.

2.2.3 Frequency spectrum

Pressing the down arrow button once more brings up a display similar to that shown opposite, where the vibration levels are shown as a frequency spectrum in the range from 0 to 1kHz.

The heights of the peaks indicate the RMS vibration level (in mm/s or inch/s) at each frequency point in the spectrum.



The readings to the right of the screen show the frequency (in Hz or RPM) and the RMS vibration level (in mm/s or inch/s) at the position of the cursor (red dotted line). The cursor position can be moved by use of the left (<) and right (>) arrow buttons.

Pressing the down arrow button increases the resolution of the frequency axis from 100 Lines (i.e. 10Hz or 600 RPM resolution) to 800 Lines (i.e. 1.25Hz or 75 RPM resolution). Increasing the resolution effectively **zooms** into the frequency spectrum. In order to display the full spectrum at the higher resolution the display must be **scrolled** using the left and right arrow buttons.

2.2.4 Live Update Mode

It is possible to have the meter continuously display readings that are taken at intervals of approx. 1 second.

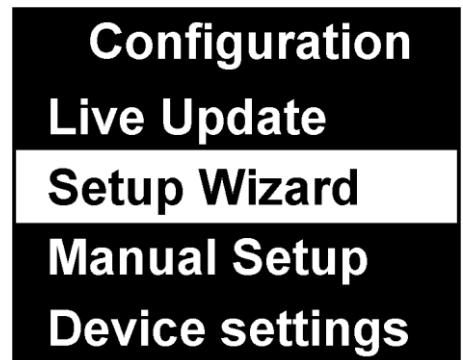
Live Update is selected from the **Configuration menu**, which is entered by holding down the circle button for approx. 2 seconds

It is possible to use live update with the basic readings screen, the VA bands screen or 100 line frequency spectrum. Pressing the circle button at any time during live update will capture a full (800 line) resolution reading.

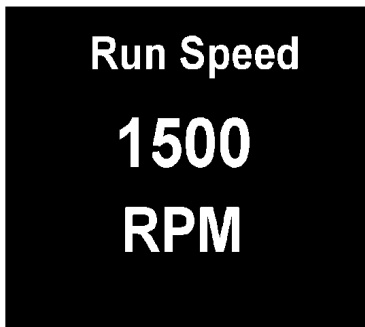
2.3 Configuration menus

The configuration menu is entered by pressing and holding down the circle button for **2 seconds**.

Moving up and down the menu is achieved by pressing the left (up) and right (down) buttons which causes the menu item to be highlighted. Pressing the circle button will select the highlighted menu item. Left and right arrow buttons can be used to move backward and forward through the menus.



2.3.1 Setup Wizard



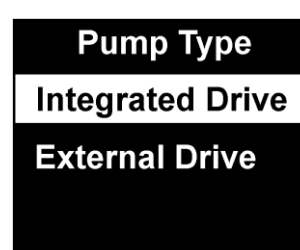
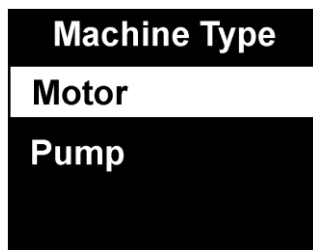
Selecting the Setup Wizard opens a dialogue that allows the machine running speed to be entered and the ISO alarm levels to be set automatically according to the size and type of machine to be monitored.

The first Setup Wizard screen to be displayed shows the currently selected running speed in the pre-selected units (Hz or RPM).

Changing the running speed is achieved by pressing the up arrow button (to increase run speed) or down arrow button (to decrease run speed).

Pressing the circle button again brings up the next screen which allows the machine type (motor or pump) to be selected.

If a **motor** is selected the size must be selected (under or over 300kW) or if a **pump** is selected, it must be specified whether it has an integrated or external drive unit.



Selecting the machine type and size allows the ISO alarm levels to be set accordingly, as does specifying the type of mounting (rigid or flexible).



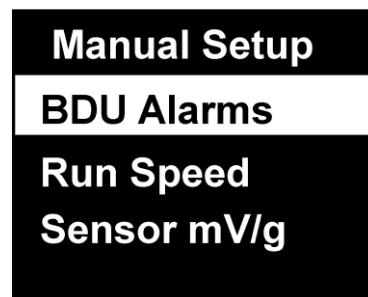
As a basic “rule of thumb”, unless a machine is bolted down to a concrete floor, its mounting should be considered as being **flexible**.

Most motors and pumps are mounted on some kind of frame or structure and as such should definitely be considered as flexibly mounted.

2.3.2 Manual Setup

2.3.2.1 BDU alarm settings

Selecting **BDU Settings** allows the alarm levels at which the BDU readings change colour to be altered by user. Normal levels are displayed on a **Green** background.



the



The BDU threshold values are designated as Warning (where readings turn **Amber**) and Critical (where readings turn **Red**).

Both these threshold values can be set independently using the up and down arrow buttons.

The default BDU thresholds are 50 for **Warning** and 100 for **Critical**. These levels are typical for medium sized machine bearings operating at run speeds in the region of 1000 to 3000 RPM. Larger bearings or higher run speeds may need increased BDU threshold values to identify worn or bad bearings.

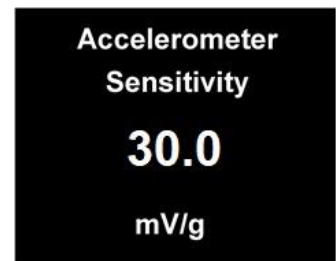


2.3.3.2 Run Speed

Run speed can also be set manually via the up and down arrow buttons.

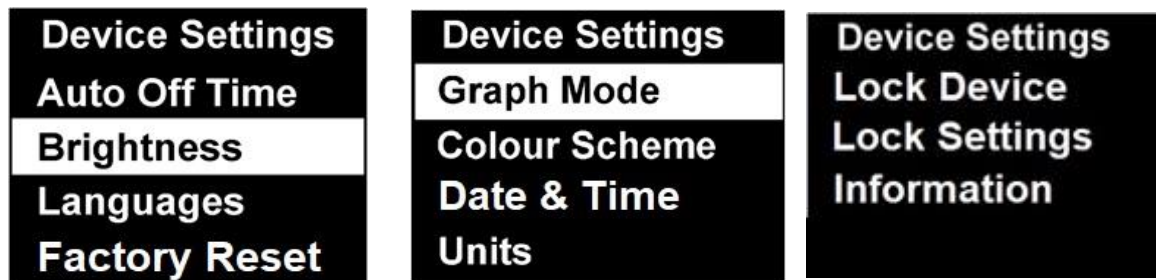
2.3.3.3 Sensor mV/g

Accelerometer sensitivity (in mV/g) can be manually set using the up and down arrow buttons to allow use of any desired sensitivity sensor within the range 1mV/g to 1000mV/g. This enables the resolution and range of the meter to be set by the user.



2.3.4 Device Settings

There are three pages of Device Settings menus. To advance to the second and third pages the down arrow button should be used. Selecting a menu option is achieved by the up and down arrow buttons and by pressing the circle button.



The **Auto Off Time** can be set from 1 minute up to a maximum value of 60 minutes, in increments of 1 minute.

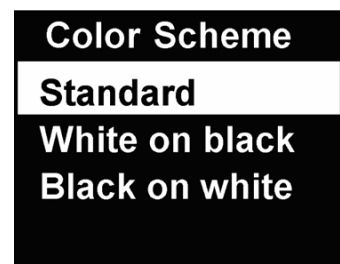
The **Brightness** level can be set anywhere between 1 (least brightness) up to 10 (full brightness).

The operating **Language** can be selected from any one of a number of different languages depending on the exact model.

Factory Reset will reboot the 9084 and set all parameters back to factory defaults.

The **Graph Mode** can be set to display the frequency spectrum as either a **Line** graph or a **Bar** graph.

The display **Color Scheme** can be configured as standard (full colour) or monochrome, e.g. for convenient viewing in direct sunlight.



Date & Time setting can be achieved using the up, down, left and right arrow buttons.

Selecting **Units** from the Device Settings menu allows the velocity readings to be displayed in either mm/s or inch/s. Run Speed units can be displayed in units of Hertz³ (Hz), revolutions per minute (RPM) or cycles per minute (CPM). The velocity type can be selected between RMS and Peak. Displacement units can be set to Peak or Peak to Peak.


³ Hertz are equivalent to, and also sometimes referred to as, cycles per second (CPS).

Lock Device immediately locks the 9084 to prevent unauthorized use. To unlock the 9084 turn the 9084 on and press the center key for several seconds until you are prompted to enter the unlock code. The default unlock code is 375.

Lock Settings locks out the ability to get into the menu to change settings without the unlock code. In this mode the 9084 will still take readings but the menu is inaccessible unless the unlock key is entered. To unlock and turn off this feature turn the 9084 on and press the center key for several seconds until you are prompted to enter the unlock code. The default unlock code is 375.

Information displays the firmware version of the 9084 and the serial number.

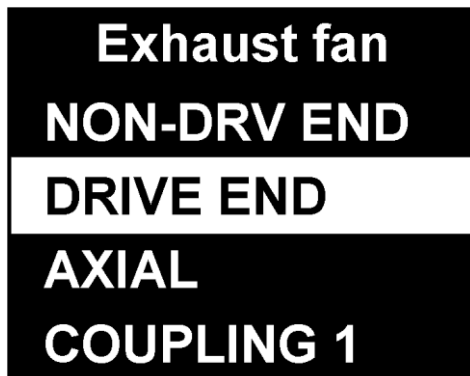
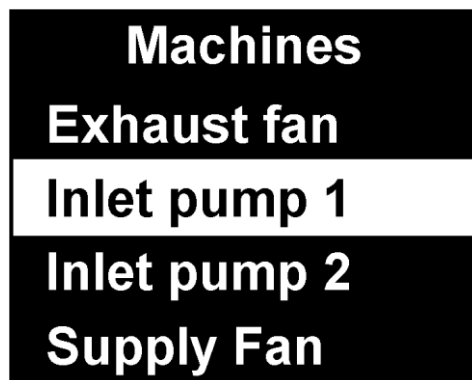
3 Asset Management

Pressing the Asset Manager button (factory key,  located just below the down arrow button) brings up the Machines menu.

Machines have user-defined names up to 16 characters long.

Scrolling the list of machines is achieved with the up and down arrow buttons.

Selecting a machine is done with the circle button, which then brings up a list of **measurement points** for that machine.

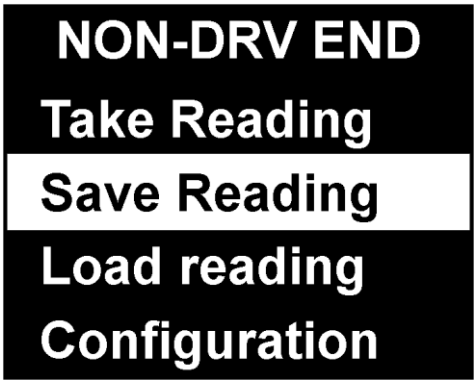


Measurement points also have user-defined names up to 16 characters long.

The list of measurement points can also be scrolled by using the up and down arrow buttons and each measurement point can be selected using the circle button.

The various options for each measurement point (MP) are then displayed:

1. Take Reading – takes a new reading and saves it to this MP
2. Save Reading – saves the previously taken reading to this MP
3. Load Reading – loads a previous reading (e.g. for re-display)
4. Configuration - allows the run speed and alarm levels to be set independently for each individual MP.



Machines and their measurement points are downloaded from **VibTrend**, the supplied trending and asset management software for PC using the supplied USB docking cradle.

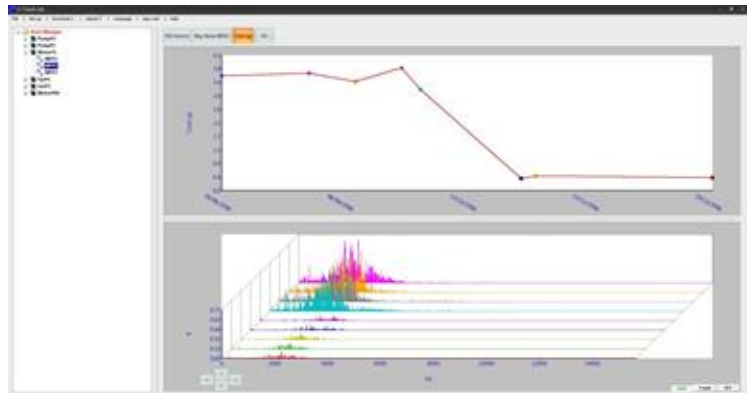
The exact list of machines to be downloaded is determined by the user in VibTrend.

There will also always be a machine downloaded named '**off route**' that contains 10 MPs. This is done to allow users to save readings for upload to VibTrend where they can then be saved to a new or existing machine.

4 VibTrend - Trending Software

VibTrend is the PC based software that allows users to view trends of vibration readings taken with the Vib Meter 9084, in a way that enables predictions to be made about machine condition.

VibTrend is available for download free of charge from:
<http://tpi.pocketvibradownload.com/>



VibTrend is very intuitive and very easy to drive and its full functionality is described in more detail in its built-in Help Guide.

In brief, VibTrend allows display of vibration data in a variety of different ways including vibration frequency spectra, bearing noise and ISO trend plots, waterfall diagrams (see figure below) and can generate reports either manually or automatically (e.g. by sending out **email alerts**).

5 Specifications

Size	200 mm x 60mm x 26mm
Weight	280g (not including magnet)
Environmental	
Water, Sand & Dust:	IP67 Waterproof
Operating:	32°F to 122°F (0°C to 50°C)
Storage:	-4°F to 158°F (-20°C to 70°C*) *Batteries not installed
Power supply	Lithium-Ion wireless rechargeable battery
Battery life	Auto power OFF - typically 20 hours continuous operating time depending on brightness setting.
Frequency range	2 Hz to 1 kHz (ISO) / 1 kHz to 10 kHz (BDU)
Max frequency resolution	1.25 Hz @ 800 lines FFT setting
Accuracy	+/-5%
Measurements	Acceleration in g, Velocity in mm/s (or inch/s), Bearing noise in BDU (bearing damage units), Displacement (mm, microns, inch)
Displayed Frequency Units	Hertz (Hz), RPM or CPM
Input range	User selectable with accelerometer sensitivity
Dynamic range	96 dB (0.01g resolution)
VA diagnostic bands (RPM = run speed)	Unbalance 1x RPM / Alignment 2x RPM /Looseness 3x RPM
Accessories	<ul style="list-style-type: none"> · A9081A PC docking cradle – USB connection · A9106 Carrying case · A9100 Low power accelerometer · A9073 Magnet for accelerometer · A9105 Curly cable for low power accelerometer · A9086 Protective boot
Optional Accessories	<ul style="list-style-type: none"> · A9091 C-Trend II software

6 Basic operation

Colour coded display shows ISO reading, bearing quality in Bearing Damage Units (BDU) and RMS acceleration (g)

ISO and BDU values are alarm colour coded in Green, Amber and Red

Additional screens show displacement (mm or microns), frequency spectrum with cursor, and diagnostics for unbalance, misalignment and looseness.

5 pin MIL connector enables connection of the low power accelerometer.

Power On/Off (left) and Menu (right) buttons.

Press **Circle** button to take readings - left, right, up and down arrows to navigate display

Asset manager button for downloading routes to the 9084 or transferring machine readings to PC for **TRENDING**

Accesses menu for adding readings to machines (assets)



Notes:

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